ing the cost of scientific researches. The board of trustees consists of five members: Dr. Henry P. Bowditch, chairman; William Minot, jun., treasurer; Prof. Edward C. Pickering; Gen. Francis A. Walker; and Dr. Charles S. Minot, secretary. It was considered important to have as great a variety of interests represented as possible, and this is accomplished by the association of the above gentlemen.

When the International association is organized (and it is hoped that the movement will be initiated by the British association at Aberdeen), the income of the fund will presumably be expended under the direction of that new association; until then, under the direction of the trustees. The first appropriation will probably be made next autumn, when several hundred dollars will become available. At the proper time a circular will be issued, announcing the manner in which applications may be made. As it is desired to give the fund an international character, it is hoped that foreign journals will copy this notice.

In conclusion, I wish to express my admiration for the wisdom shown by Mrs. Thompson. It is certainly very remarkable that a person not especially versed in science, nor directly interested in any of its branches of investigation, should be induced by a desire to benefit her fellows, not to give for some temporary need, but, with exceptional insight, to give for the development of the very sources of progress. The same sound judgment governed her decision as to the conditions of her gift, for it is difficult to foresee any probability which will render this endowment futile. Very often the object of a public gift is determined by the donor's personal interests. I believe Mrs. Thompson was governed by her convictions as to the application of her money which would do most good. She is a devout person, and trusts in the peaceful union of true religion and true science.

At their first meeting the trustees voted unanimously to call their trust 'THE ELIZABETH THOMPSON SCIENCE FUND.'

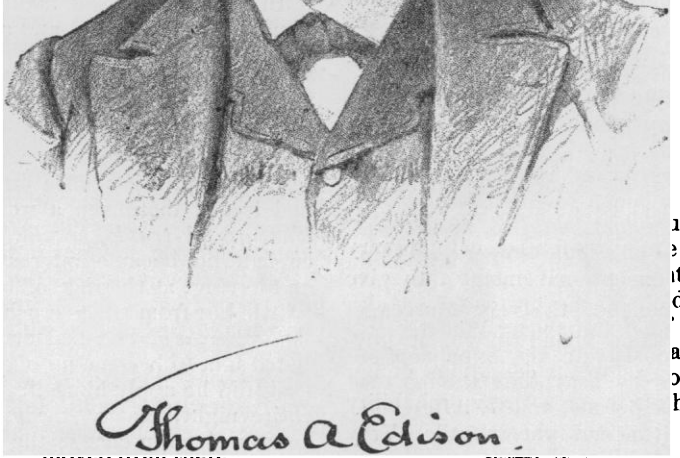
CHARLES SEDGWICK MINOT.

THOMAS ALVA EDISON.

THOMAS ALVA EDISON was born at Milan, Erie county, Ohio, on the 11th of February, 1847. His ancestors on his father's side were of Dutch descent, having emigrated from Holland to the United States in 1730. His mother, Mary Elliot by name, though a native of Massachusetts, was originally of Scotch parentage. She had for some years taught in a Canadian high school, and was possessed of an excellent education. Under her careful training, her son, in the almost entire absence of the ordinary educational privileges, developed very early a fondness for books, which became almost a passion. Before he was ten years old he had read not only Newton's 'Principia' and Ure's 'Dictionary,' but also Hume's 'England,' Gibbon's 'Rome,' D'Aubigné's 'Reformation,' and Burton's 'Anatomy of melancholy;' and at the age of twelve he undertook the task of reading through the public library of Detroit in course, becoming convinced, after wading indiscriminately through fifteen feet of shelving, that it would be better for him to make a selection of works upon his favorite subjects.

In 1854 the Edison family removed to Port Huron in Michigan, and a few years later young Edison became a train-boy on the Grand-trunk railway. When the line was completed between Port Huron and Detroit, he secured the exclusive right upon it as news-agent, employed four or more assistants, fitted up a printing-office in the baggage-car, and issued therefrom a weekly journal called *The grand-trunk herald*. While thus occupied, he became interested in telegraphy; and having, at the risk of his own life, saved a little boy from being crushed under the train, the father, a station-master upon the road, assisted him to become an operator. So assiduously did he apply himself, practising often the entire night, that at the end of five months he was given in charge the telegraph-office at Port Huron.

As a telegraph-operator his career was a checkered one. He was employed chiefly for night-work in positions of increasing importance, until finally he reached the larger offices of Indianapolis and Cincinnati. Everywhere his desire for information, his originality in suggestion, the novelty of his speculations, his exemplary conduct, and his uniform good nature, won for him the regard and esteem of his associates. In 1864 he went to Memphis as a government operator; and thence he removed to Louisville, where he remained two



Thomas A Edison.

insuccessful. Penniless and disheart- went to New York in search of em- t. Chancing to be in the office of the d stock company when a serious break- their apparatus occurred, the officials, air, allowed Edison, then unknown to o try his skill upon it. His success his ability, and he was at once given an important position. Soon afterward the Western union telegraph company and the Gold and stock company entered into a joint agreement with Edison, by which he bound himself to give them the first refusal of all his inventions relating to telegraphy. Thereupon he opened an extensive shop at Newark, and entered upon a period of experimentation and invention. Here he toiled arduously by day and by night, having upon his hands at one time, it is said, no less than forty-five different inventions and improvements in process of development. The constant strain thus put upon him overtaxed his strength. He gave up manufacturing altogether, and in 1876 removed to Menlo Park, where he built and equipped an experimental laboratory, and devoted himself entirely to investigation. From this laboratory most of the inventions have issued which have made Edison so well known.

moved from there to Boston, where he was put in charge of a heavy wire to New York.

Thomas A Edison.

It is as an inventor, however, that Edison is best known in the community. His first invention was an automatic telegraph-repeater, and was made in 1863, while an operator in Indianapolis, though it was not put into practical operation until some time afterward, at Memphis. It was while operating at this latter place that the possibility of duplex transmission occurred to him. And although the instruments required to test his method were constructed while he was in Cincinnati, it was not until 1870 that they were actually tried upon the line. On reaching Boston, he found an appreciative friend in Mr. Milliken, under whose active encouragement his inventive talent rapidly developed. He devised a dial or indicating-telegraph for local lines, a chemical-recorder for voting purposes, and a private line-printer, experimenting at the same time, between Boston and Portland, on vibratory telegraph-instruments.

His experiment on duplex transmission was made between New York and Rochester, and

Up to the present time, Edison has taken out in this country about four hundred patents, — a fact which shows most clearly the prolific character of his mind. Of these, not far from one-fourth relate to telegraphy, — chemical, au-

tomatic, acoustic, duplex, quadruplex, sextuplex, printing, fire-alarm, district, and domestic; about the same number have reference to electric-lighting; while the remainder refer to the telephone, the electric transmission of power, the electric pen, and other miscellaneous inventions. Among all these, perhaps the most remarkable are the quadruplex telegraph, by which two messages may be sent simultaneously in opposite directions from each end of the line; the automatic telegraph, which can transmit a thousand words a minute; the motograph relay; the carbon telephone; the Edison system of electric-lighting by incandescence; and the Edison electric railway.

Besides his inventive talent, Edison possesses marked ability as an investigator. He discovered independently the variation in resistance produced in semi-conductors by pressure; utilizing afterward this fact in the construction of his transmitting telephone, his tasimeter, and his telephone relay. He first observed the curious fact that the passage of an electric current between a metallic and a moist semi-conducting surface varies the friction between these surfaces, — a phenomenon supposed at first to be electrolytic, though now believed to be electro-capillary. This fact he at once applied to practical use in the motograph relay and the loud-speaking telephone. While experimenting with platinum for the purposes of electric-lighting, he observed that this metal occluded an enormous amount of gas, and noted the remarkable fact that the fusing-point of the metal rose as this gas was expelled; so that a platinum coil, after long-continued treatment at a high temperature in a vacuum, could be made to give many times as much light as a coil of the untreated metal. Hence he propounded the theory that the annealing process consists in the expulsion of the occluded gases by heat, thus leaving the metal more or less porous, and therefore soft and flexible. The various phenomena which he has observed in his incandescent lamps are of great scientific interest. In the first place, these lamps are of exceptional efficiency as condensers. In the second, the Crookes effect is very marked in them, and is equally curious, whether we explain it on Edlund's assumption that a vacuum is a conductor, or on the more probable hypothesis of Rowland, electrical transference by convection. More surprising still, perhaps, is the fact of the ready passage of the current through the glass of these lamps, as proved by him, even at the base, where the glass is not heated.

Of all his discoveries, however, that of the phonograph has undoubtedly given him the widest general reputation. The extreme simplicity of the apparatus by which the tones of the human voice could be recorded, and afterwards faithfully reproduced, excited great interest, not only among the masses, but also in scientific circles, since it promised to be a valuable instrument for the investigation of articulate speech. His latest contribution to science, a photometer containing an accurate standard of light, bids fair to add equally to his well-earned reputation. These facts, among others that might be mentioned, are quite sufficient to show Edison's acuteness as an original observer, and to establish his capability in the direction of independent research. It is much to be regretted that want of time, and a decided distaste for the manual labor of putting his thoughts upon paper, has prevented him hitherto from placing his discoveries on permanent record.

The exhibit made by Edison in 1881 at the Electrical exhibition in Paris was a most interesting one. On both sides of the ocean he had been severely criticised, and often abused, for views held to be chimerical and absurd. At very considerable trouble and expense, therefore, he prepared an elaborate collection of apparatus illustrating his inventions, including many articles of great historic value, and sent them to Paris, in order, as he said, to prove whether or not he had made original discoveries and inventions. The extreme ingenuity of these devices, the thorough knowledge of scientific principles everywhere shown in them, and the great electrical and mechanical skill evident in their construction, won for him, unsolicited, the most complimentary encomiums, and secured without opposition the highest award within the gift of the jury.

In person, Edison is of medium height, rather stout, and quite informal in manner. His face is clean-shaven; his hair dark, with here and there a tinge of gray; and his eyes brown, deep-set, but sharp and clear. A slight deafness gives him a rather absent, and sometimes listless air, which disappears at once, as soon as he becomes interested in conversation. In his experimentation he is minute and painstaking, noting carefully the phenomena he is investigating, and recording accurately the results. Moreover, he is not only quick to observe facts, but prompt to detect their practical importance, and ready to seize upon such of them as may serve as the basis of an invention. His mode of living is extremely simple. In his manners and way

of life, he is far removed from any thing approaching assumption or conventionality. His disposition is amiable and retiring. He is now in the full vigor of health, and, at the age of thirty-eight, finds himself in possession of a well-earned and solid reputation. Should that long life — which seems to be a legacy in his family — be vouchsafed to him, very much more of discovery and invention may be looked for from him as the result of his maturer thought and larger experience.

THE ELECTRIC RAILWAY IN NEW YORK.

For several years past, the question of running the New-York elevated railroads by electricity has been agitated. This culminated in a meeting held in New-York City on the 18th of November, 1884, at which were present representatives of the Edison, Daft, Field, Siemens, Brush, and Bently-Knight electric railways, and also of the New-York elevated railway. At this, and five subsequent meetings, it was decided to test each system of applying electricity as a motive power for railways upon a certain portion of the elevated road. To pass judgment as to the relative values of the various systems, the following gentlemen were appointed to form a board of arbitrators: Sir William Thomson, Prof. Charles R. Cross, George B. Roberts, James H. Rutter, and Robert Harris. It was, moreover, decided to finish the test, if possible, within ninety days. This time has long since elapsed, and the waiting public have heard no report.

During this time, however, a vast amount of work has been done, and great difficulties surmounted. The great delays have been occasioned by the mechanical application of the electric-motor to the heavy and quickly moving trains. In the various systems to be tested, a third rail will be employed; and the laying of this, combined with its proper insulation, has consumed a vast amount of time.

In spite of all difficulties, the Daft company have completed their preparations, and are ready to start. As in other systems, the electric circuit is made from the dynamo to the central rail, through the collector to the motor, thence to the wheels and rails, and back to the dynamo. This company have laid their third rail upon the Ninth-avenue line, commencing at 14th Street. This rail is insulated by the Daft patent insulator, which prevents water from making a connection from rail to sleeper, thus insuring good insulation in all weathers. The road is further equipped by completing the electrical contacts at the joints of the outer rails.

At the end of this line the company have located their central station. They have placed in position a large William Wright engine, with the necessary boilers and shafting. Two fifty-horse-power Daft dynamos are now in position, and, later, a third will be erected to relieve the others, in case of accident. The wires are carried from the station to the rails through the streets upon poles.

The motor, Benjamin Franklin, has been for some weeks finished, and has been thoroughly tested. The motor is fourteen feet six inches long, and six feet nine inches wide, and weighs nine tons. The schematic drawing (fig. 1.) will show the manner in which the motor is arranged. No attempt is made here to reproduce the proportions of the Benjamin Franklin. One of the largest-sized Daft mo-

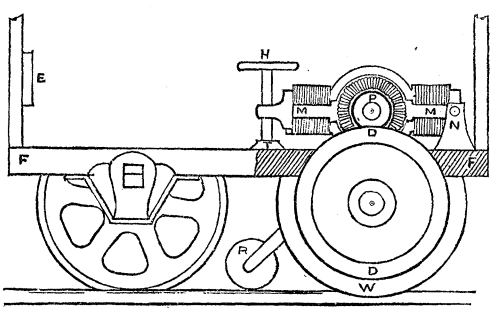


Fig. 1.

tors *MM*, is mounted upon the truck *FF*. The motor is hung so that it turns about *N* as an axis. The other end is supported by the screw *H*. The maximum capacity of this motor is three hundred ampères, with an electro-motive force of a hundred and eighty-five volts. The power is transmitted from the motor to the wheels by the grooved friction-gearing *P* and *DD*. *P* is keyed to the armature shaft, and *DD* to the drive-wheel shaft. The flange of the drive-wheel, on the farther side, is shown at *W*. These gears are duplicated on the other side of the motor. The amount of pressure upon the friction-gears is regulated by the screw *H*. This screw is also advantageous in case of repairs, for by means of it the motor may be moved completely off its friction bearings. The support *N*, of one end of the motor, is cushioned with heavy strips of rubber, as is also the cap *T*, upon which the screw rests. The trucks are likewise cushioned, thus allowing freedom of motion in any